

CLAIMS

What is claimed is:

1. A data storage device preamplifier circuit, comprising:
 - a write amplifier having an input and an output;
 - a read amplifier having an input and an output; and
 - a loopback circuit that selectively connects said output of said write amplifier to said output of said read amplifier.
2. The data storage device preamplifier circuit of Claim 1 wherein said write amplifier amplifies said write signal that is received from a read channel circuit and outputs said amplified write signal to a read/write device and wherein said read amplifier amplifies said read signal that is received from the read/write device and outputs said amplified read signal to the read channel circuit.
3. The data storage device preamplifier circuit of Claim 2 wherein said loopback circuit includes at least one of a switch and a multiplexer that selectively connects said output of said write amplifier to said output of said read amplifier.
4. The data storage device preamplifier circuit of Claim 3 further comprising a trigger circuit that controls said at least one of said switch and said multiplexer.

5. The data storage device preamplifier circuit of Claim 3 wherein at least one of said switch and said multiplexer is controlled by a write enable signal that is generated by the read channel circuit.

6. The data storage device preamplifier circuit of Claim 1 wherein said read amplifier is shut down when said loopback circuit connects said output of said write amplifier to said output of said read amplifier.

7. A data storage device preamplifier circuit, comprising:
a write amplifier having an input and an output;
a read amplifier having an input and an output; and
a loopback circuit that selectively connects said output of said write amplifier to said input of said read amplifier.

8. The data storage device preamplifier circuit of Claim 7 wherein said loopback circuit further includes an attenuation circuit that attenuates said output of said write amplifier when said loopback circuit is active.

9. The data storage device preamplifier circuit of Claim 7 wherein said write amplifier amplifies said write signal that is received from a read channel circuit and outputs said amplified write signal to a read/write device and wherein said read amplifier amplifies said read signal that is received from the read/write device and outputs said amplified read signal to the read channel circuit.

10. The data storage device preamplifier circuit of Claim 9 wherein said loopback circuit includes:

at least one of a switch and a multiplexer that selectively connects said output of said write amplifier to said input of said read amplifier; and

an attenuation circuit that attenuates said output of said write amplifier when said loopback circuit is active.

11. A read channel circuit for a data storage device, comprising:
- a first counter that generates a first count of an attribute of a write signal that is output by said read channel circuit; and
 - a second counter that generates a second count of said attribute of a looped-back write signal that is received by said read channel circuit.
12. The read channel circuit of Claim 11 further comprising a comparator that compares a difference between said first count and said second count to a threshold and that outputs a first state when said difference is less than said threshold and a second state when said difference is not less than said threshold.
13. The read channel circuit of Claim 11 wherein said read channel circuit generates a write enable signal that is output to a preamplifier circuit to enable a loopback mode of the preamplifier circuit.
14. The read channel circuit of Claim 11 wherein said attribute is at least one of a rising edge, a falling edge and a pulse.

15. A read/write path for a data storage device, comprising:
a read channel circuit; and
a preamplifier circuit that communicates with said read channel circuit and that includes a loopback circuit.

16. The read/write path of Claim 15 wherein said preamplifier circuit includes:

a write amplifier that amplifies a write signal from said read channel circuit and that outputs said amplified write signal to the read/write device; and

a read amplifier that amplifies a read signal received from the read/write device,

wherein said loopback circuit communicates with said write amplifier and said read amplifier and selectively provides a loopback path to test the operation of said write amplifier.

17. The read/write path of Claim 16 wherein said loopback circuit selectively connects an output of said write amplifier to an output of said read amplifier.

18. The read/write path of Claim 16 wherein said loopback circuit includes at least one of a switch and a multiplexer that selectively connects an output of said write amplifier to said output of said read amplifier.

19. The read/write path of Claim 16 wherein said read amplifier is shut down when said loopback circuit connects said output of said write amplifier to said input of said read amplifier.

20. The read/write path of Claim 18 further comprising a trigger circuit that controls said at least one of said switch and said multiplexer.

21. The read/write path of Claim 18 wherein said read channel circuit generates a write enable signal that controls said at least one of said switch and said multiplexer.

22. The read/write path of Claim 16 wherein said loopback circuit includes:

at least one of a switch and a multiplexer that selectively connects an output of said write amplifier to an input of said read amplifier; and

an attenuation circuit that attenuates said output of said write amplifier when said loopback circuit is active.

23. The read/write path of Claim 15 wherein said read channel circuit includes:

a first counter that generates a first count of an attribute of a write signal that is output to said preamplifier circuit;

a second counter that generates a second count of said attribute of a loop-back write signal that is received from said preamplifier circuit; and

a comparator that determines an operating condition of the preamplifier circuit based on said first count and said second count.

24. The read/write path of Claim 23 wherein said comparator compares a difference between said first count and said second count to a threshold and outputs a first state when said difference is less than said threshold and a second state when said difference is not less than said threshold.

25. The read/write path of Claim 23 wherein said read channel circuit generates a write enable signal that is output to said preamplifier circuit.

26. The read/write path of Claim 15 wherein said read channel circuit includes:

- a data generator that generates a test symbol;
- an encoder that encodes said test symbol and outputs a write signal to said preamplifier circuit,
- a decoder that decodes a read signal received from said preamplifier circuit and that generates a received symbol; and
- a comparator that compares said test symbol to said received symbol, that outputs a first state when a match occurs and outputs a second state when a match does not occur.

27. The read/write path of Claim 26 further comprising a delay circuit that communicates with said data generator and said comparator.

28. The read/write path of Claim 15 further comprising:

- a hard drive controller (HDC) that communicates with said read channel and that includes:
 - a data generator that generates a test symbol that is output to said read channel;
 - a comparator that compares said test symbol to a received symbol from said read channel, that outputs a first state when a match occurs and outputs a second state when a match does not occur.

29. The read/write path of Claim 28 further comprising a delay circuit that communicates with said data generator and said comparator.

30. The read/write path of Claim 23 wherein said attribute is at least one of a rising edge, a falling edge and a pulse.

31. A data storage device preamplifier circuit, comprising:
write amplifying means having an input and an output for amplifying a write signal;
read amplifying means having an input and an output for amplifying a read signal; and
loopback means for selectively connecting said output of said write amplifying means to said output of said read amplifying means.

32. The data storage device preamplifier circuit of Claim 31 wherein said write amplifying means amplifies said write signal that is received from a read channel circuit and outputs said amplified write signal to a read/write device and wherein said read amplifying means amplifies said read signal that is received from the read/write device and outputs said amplified read signal to the read channel circuit.

33. The data storage device preamplifier circuit of Claim 32 wherein said loopback means includes switching means for selectively connecting said output of said write amplifying means to said output of said read amplifier.

34. The data storage device preamplifier circuit of Claim 33 further comprising trigger means for controlling said switching means.

35. The data storage device preamplifier circuit of Claim 33 wherein said switching means is controlled by a write enable signal from the read channel circuit.

36. The data storage device preamplifier circuit of Claim 31 wherein said read amplifying means is shut down when said loopback means connects said output of said write amplifying means to said output of said read amplifying means.

37. A data storage device preamplifier circuit, comprising:

write amplifying means having an input and an output for amplifying a write signal;

read amplifying means having an input and an output for amplifying a read signal; and

loopback means for selectively connecting said output of said write amplifying means to said input of said read amplifying means.

38. The data storage device preamplifier circuit of Claim 37 wherein said loopback means includes attenuation means for attenuating said output of said write amplifying means when said loopback means is active.

39. The data storage device preamplifier circuit of Claim 37 wherein said write amplifying means amplifies said write signal that is received from a read channel circuit and outputs said amplified write signal to a read/write device and wherein said read amplifying means amplifies said read signal that is received from the read/write device and outputs said amplified read signal to the read channel circuit.

40. The data storage device preamplifier circuit of Claim 39 wherein said loopback means includes:

switching means for selectively connecting said output of said write amplifying means to said input of said read amplifying means; and

attenuating means for attenuating said output of said write amplifying means when said loopback means is active.

41. A read channel circuit for a data storage device, comprising:
first counting means for generating a first count of an attribute of a write signal that is output by said read channel circuit; and
second edge counting means for generating a second count of said attribute of a looped-back write signal that is received by said read channel circuit.

42. The read channel circuit of Claim 41 further comprising comparing means for comparing a difference between said first count and said second count to a threshold and for generating a first state when said difference is less than said threshold and a second state when said difference is not less than said threshold.

43. The read channel circuit of Claim 41 wherein said read channel circuit generates a write enable signal that is output to a preamplifier circuit to enable a loopback mode of the preamplifier circuit.

44. The read channel circuit of Claim 41 wherein said attribute is at least one of a rising edge, a falling edge and a pulse.

45. A read/write path for a data storage device, comprising:

read channel means for generating write signals and for receiving read signals; and

preamp means that communicates with said read channel means for amplifying said write signals and said read signals and including loopback means for providing a loopback path for testing said preamp means.

46. The read/write path of Claim 45 wherein said preamp means includes:

write amplifying means for amplifying a write signal from said read channel means and for outputting said amplified write signal to a read/write device; and

read amplifying means for amplifying a read signal received from the read/write device, wherein said loopback means communicates with said write amplifying means and said read amplifying means.

47. The read/write path of Claim 46 wherein said loopback means includes switching means for selectively connecting an output of said write amplifying means to an output of said read amplifying means.

48. The read/write path of Claim 47 further comprising trigger means for controlling said switching means.

49. The read/write path of Claim 47 wherein said read channel means generates a write enable signal that controls said switching means.

50. The read/write path of Claim 46 wherein said read amplifying means is shut down when said loopback means connects said output of said write amplifying means to said output of said read amplifying means..

51. The read/write path of Claim 46 wherein said loopback means includes:

switching means for selectively connecting an output of said write amplifying means to said read amplifying means; and

attenuation means for attenuating said output of said write amplifying means during said loopback mode.

52. The read/write path of Claim 45 wherein said read channel means includes:

first counting means for generating a first count of an attribute of a write signal that is output to said preamp means;

second counting means for generating a second count of said attribute of a looped-back write signal that is received from said preamp means; and

comparing means for determining an operating condition of the preamp means based on said first count and said second count.

53. The read/write path of Claim 52 wherein said comparing means compares a difference between said first count and said second count to a threshold and outputs a first state when said difference is less than said threshold and a second state when said difference is not less than said threshold.

54. The read/write path of Claim 52 wherein said read channel means generates a write enable signal that is output to said preamp means.

55. The read/write path of Claim 45 wherein said read channel means includes:

data generating means for generating a test symbol;

encoding means for encoding said test symbol and outputting a write signal to said preamp means;

decoding means for decoding a read signal received from said preamp means and for generating a received symbol; and

comparing means for comparing said test symbol to said received symbol, outputting a first state when a match occurs and outputting a second state when a match does not occur.

56. The read/write path of Claim 55 further comprising delay means that communicates with said data generating means and said comparing means for providing a delay.

57. The read/write path of Claim 45 further comprising hard drive controller (HDC) means for controlling a hard drive and for communicating with said read channel means and that includes:

data generating means for generating a test symbol that is output to said read channel means; and

comparing means for comparing said test symbol to a received symbol from said read channel means, outputting a first state when a match occurs and outputting a second state when a match does not occur.

58. The read/write path of Claim 57 further comprising delay means that communicates with said data generator and said comparing means for providing a delay.

59. The read/write path of Claim 52 wherein said attribute is at least one of a rising edge, a falling edge and a pulse.

60. A method for testing operation of a preamplifier circuit, comprising:
generating a first count of an attribute of a write signal;
transmitting said write signal to a write signal input of said preamplifier circuit; and
looping said write signal back to a read signal output of said preamplifier circuit.

61. The method of Claim 60 further comprising generating a second count of said attribute of said looped-back write signal.

62. The method of Claim 61 further comprising:
comparing said first count to said second count; and
diagnosing operability of said preamplifier circuit based on said comparison.

63. The method of Claim 62 further comprising:
generating a difference between said first count and said second count; and
comparing said difference to a threshold.

64. The method of Claim 63 further comprising signaling non-operability of said preamplifier circuit when said difference is greater than said threshold.

65. The method of Claim 60 wherein said preamplifier circuit includes a read amplifier and further comprising shutting said read amplifier down during said looping step.

66. A method for testing operation of a preamplifier circuit, comprising:
generating a first symbol;
converting said first symbol into a write signal;
transmitting said write signal to a write signal input of said preamplifier circuit; and
looping said write signal back to a read signal output of said preamplifier circuit.
67. The method of Claim 66 further comprising converting said looped-back write signal into a received symbol.
68. The method of Claim 67 further comprising:
comparing said first symbol to said received symbol; and
diagnosing operability of said preamplifier circuit based on said comparison.
69. The method of Claim 67 further comprising signaling non-operability of said preamplifier circuit when said first symbol does not match said received symbol.

70. A method for operating a preamplifier circuit having a write signal input and a read signal output, comprising:

receiving a write signal at said write signal input of said preamplifier; and

selectively looping back said write signal to said read signal output.

71. The method of Claim 70 further comprising amplifying said write signal before said looping back step.

72. The method of Claim 71 further comprising further amplifying said write signal after said amplifying and loopback steps.

73. The method of Claim 72 further comprising attenuating said write signal before said further amplifying step.

74. The method of Claim 70 further comprising shutting down a read amplifier of said preamplifier circuit when said loopback step is performed.

75. The method of Claim 70 further comprising:

- generating a first count an attribute of said write signal that is input to said write signal input of said preamplifier circuit;
- generating a second count of said attribute of said write signal output at said read signal output of said preamplifier circuit; and
- comparing said first count and said second count.

76. The method of Claim 75 further comprising:

- generating a difference between said first count and said second count;
- comparing said difference to a threshold; and
- signaling non-operability of said preamplifier circuit when said difference is greater than said threshold.

77. The method of Claim 70 further comprising:

- generating a first symbol;
- converting said first symbol into a write signal; and
- transmitting said write signal to said write signal input of said preamplifier circuit.

78. The method of Claim 77 further comprising converting said looped-back write signal into a received symbol.

79. The method of Claim 78 further comprising:
comparing said first symbol to said received symbol; and
diagnosing operability of said preamplifier circuit based on said comparison.

80. The method of Claim 79 further comprising signaling non-operability of said preamplifier circuit when said first symbol does not match said received symbol.

81. A method for operating a preamplifier circuit, comprising:
selectively operating said preamplifier circuit in a write mode;
selectively operating said preamplifier circuit in a read mode; and
selectively operating said preamplifier circuit in a write mode with
loopback.

82. The method of Claim 81 wherein said write mode with loopback
further comprises:

receiving a write signal at a write signal input of said preamplifier;
amplifying said write signal; and
looping back said write signal to a read signal output of said
preamplifier.

83. The method of Claim 82 further comprising further amplifying said
write signal after said amplifying and loopback steps.

84. The method of Claim 83 further comprising attenuating said write
signal before said further amplifying step.

85. The method of Claim 82 further comprising shutting down a read
amplifier of said preamplifier circuit when said loopback step is performed.

86. The method of Claim 82 further comprising:

- generating a first count an attribute of said write signal that is input to said write signal input of said preamplifier circuit;
- generating a second count of said attribute of said write signal output at said read signal output of said preamplifier circuit; and
- comparing said first count and said second count.

87. The method of Claim 86 further comprising:

- generating a difference between said first count and said second count;
- comparing said difference to a threshold; and
- signaling non-operability of said preamplifier circuit when said difference is greater than said threshold.

88. The method of Claim 82 further comprising:

- generating a first symbol;
- converting said first symbol into a write signal; and
- transmitting said write signal to said write signal input of said preamplifier circuit.

89. The method of Claim 88 further comprising converting said looped-back write signal into a received symbol.

90. The method of Claim 89 further comprising:
comparing said first symbol to said received symbol; and
diagnosing operability of said preamplifier circuit based on said
comparison.

91. The method of Claim 90 further comprising signaling non-
operability of said preamplifier circuit when said first symbol does not match said
received symbol.